to be infinitely superior to the ordinary method of lecturing on the non-metallic elements and on physics, and setting qualitative analyses as practical work. The only examination of which I had experience lately is the London University Matriculation, which has recently introduced practical questions; my boys have always gone up with confidence, and found these distinctly easy, a matter in which others with whom they compared notes have not agreed with them. I have never had a failure in chemistry.

At the same time, I must insist upon the point that I do not believe that this kind of knowledge can be properly tested by examination; the true criterion of the success of this syllabus must be the opinion of those professors who carry on the scientific education of our boys after they have left us. I have received a large number of letters from various professors, in which they complain bitterly of the present preparation of most of their students, and state that they believe such changes as those contemplated by this syllabus would be of the greatest value. One of these I feel justified in quoting.

"I am a very strong advocate for change in the method of teaching science in schools. The method that usually prevails is, in my opinion, worse than barren. Not only is no satisfactory foundation laid for future teaching, but bad and slovenly habits of mind and manipulation are formed, with the result that a large portion of my work and that of my colleagues consists in the attempt (too often futile) to eradicate these habits."

The syllabus, if it has a fault, is that it is too long for an elementary course. Several of the Committee were of opinion that a course on mechanics, to lead up to the construction and use of a balance, would be sufficient; but it was pointed out that the Science and Art Department would not accept any syllabus which did not include a complete course of statics. This will explain why the syllabus includes an amount of statics out of all proportion to the other subjects; it is a sacrifice to the examination fiend; personally I should leave this work for a more advanced course.

I can, in conclusion, heartily recommend to all science teachers to try this syllabus with their classes of beginners, not following it slavishly, but adopting those points which appeal to their experience.

CHARLES M. STUART.

NOTES.

LORD KELVIN reaches this year his jubilee as Professor of Natural Philosophy in the University of Glasgow. The event will be recognised by a joint celebration, in which the City, University, and students will take part, on June 15 and 16. It is anticipated that delegates and addresses will be sent from numerous home and foreign Universities to express the esteem in which the distinguished investigator is held.

THE date fixed for the next "meeting for discussion" at the Royal Society is April 23, when the subject will be "Colour Photography," and the discussion will be opened by Prof. Lippmann.

THE Bakerian Lecture will be delivered before the Royal Society on the 20th inst., the lecturer for the year being Prof. Roberts-Austen, and the subject, "The Diffusion of Metals." The Croonian Lecture will be given, probably on March 12, by Dr. A. D. Waller, who has chosen for his subject, "Electrical Changes in Isolated Nerve."

THE Odessa correspondent of the *Times* says that the Russian Government will send a special scientific expedition to observe the total eclipse of the sun on August 9. The expedition will be in charge of three astronomers from the Nikolas Observatory at Pulkova, and leaves Odessa in May, by one of the cruisers belonging to the Russian Volunteer Fleet Committee, for Vladivostok, whence it will go near the mouth of the river Amour for observations. The Committee has agreed with the Government to convey the party from Odessa to Vladivostok and back again to Odessa free of charge.

A COMMITTEE was formed in Paris, in December last, to obtain the means for erecting a monument to Pasteur, by international subscriptions. In the furtherance of this resolution a circular has been widely distributed, appealing for funds, and asking for the organisation of local committees, so that the monument in Paris shall be worthy of the man whose labours against disease and death it will commemorate. The French Comité de Patronage includes the President of the Republic, many of the Ministry, and a large number of distinguished scientific men; while the Commission which is organising the memorial is composed of members of the Council of the Pasteur Institute. It is to be hoped that a generous response will be made to the committee's appeal for subscriptions and assistance.

A CIRCULAR has recently been issued to draw the attention of biological professors and lecturers to a course of instruction in Marine Biology which has been organised in connection with the Plymouth Laboratory of the Marine Biological Association. This course, which is intended to be supplementary to the ordinary academical courses in Comparative Anatomy, will be conducted during the forthcoming Easter vacation between March 23 and April 24, and will be superintended by Mr. W. Garstang, Fellow and Lecturer of Lincoln College, Oxford, and formerly naturalist on the staff of the Plymouth Laboratory. England has undoubtedly been behind the times in the lack of any organised arrangements by which biological students could be enabled to enjoy the various advantages which a well-equipped marine laboratory affords for the study of some of the more fascinating aspects of animal life; and it is to be hoped that this new departure in biological education in England will meet with the success and encouragement which it deserves.

JUDGING from a Reuter's telegram, a meteorite which fell at Madrid on Monday produced exceptionally striking effects. Reports of remarkable meteoritic falls are comparatively rare, so we give a fairly full transcription of the telegram:—"At half-past nine this morning an aerolite of considerable size exploded in the atmosphere above Madrid. The phenomenon was accompanied by a vivid glare of blinding light, followed by a loud report, which caused a general panic among the people. All the buildings in the city were shaken, and many windows were smashed by the concussion. The sky was clear and the sun was shining brightly at the time of the explosion, all that was visible in the heavens being a white cloud bordered with red, which was travelling eastward at a great rate, leaving behind it a train of fine, light dust. The panic was general throughout the city. Many shopkeepers closed their establishments. Not only were buildings shaken, but at least one house is known to have collapsed. At the United States Legation a partition wall fell in, and many of the windows were shattered, but no other damage was done to the building. A great many houses throughout the city sustained similar damage, partition walls being shaken down by the force of the explosion. The excitement in the city, and especially in the suburbs, has not yet calmed down. The explosion was heard over a distance of several kilometres from Madrid. At Guadalajara, a town about forty-six miles from the capital, the explosion was very strongly felt." The following official communication has been issued from the Madrid Observatory:—"At 9.29 this morning a strong light was observed proceeding from a small cloud moving from the south-west to the north-east. A minute and a half later a terrific report, followed by several others of less intensity, occurred, accompanied by a shaking of the ground and of buildings. A red-tinted cloud was for a long time visible in the east. The directors of the Observatory suppose that the phenomenon was caused by an aerolite. Owing to the time that elapsed between the observation of the explosion and the report, the aerolite must have burst at a great distance from the earth." The note adds that no traces of the meteorite have yet been found. Nevertheless, it is reported that several small pieces of greyish stone, still warm, have been picked up in Madrid.

GREAT interest has been aroused in France by the discoveries of Prof. Röntgen, and experiments have been at once made confirming and extending the original results. Last week's number of the *Comptes rendus* contained further work by M. Jean Perrin on the properties of the kathode rays (see *ante*, p. 298), showing that they are not identical with the Röntgen rays. The current issue (February 3) contains papers on this subject by MM. L. Benoist and D. Hurmuzescu, A. Nodon, V. Chabaud, and G. Moreau. The first of these gives an account of a most remarkable property of the rays, that of completely and rapidly discharging an insulated charged electroscope, the effect being produced more rapidly if the charge borne by the gold leaves is a negative one. This phenomenon is not in any way interfered with by an aluminium screen, although the latter protects the electroscope perfectly from both light and electricity. The note by M. Nodon further emphasises the difference between these rays and the ultra-violet rays. An ordinary dry plate wrapped in several thicknesses of blackened paper was exposed at a distance of 40 c.m. from a powerful arc lamp (20 amperes) for fifteen minutes; on developing, the plate was unaffected, although under the same conditions the Röntgen rays produced a very marked result. The latter also were found to pass with equal facility through differently coloured screens of the same material. The transparency of metals to the X-rays is the subject of the communication by M. Chabaud. Fourteen metals and alloys were examined by the photographic method, the results being substantially identical with those published by Prof. Röntgen in his original paper; results which were obtained very simply by the use of a phosphorescent screen. M. Chabaud makes no reference to these earlier experiments on the same subject. The two metals most opaque to these rays are those of the highest atomic weights, platinum and mercury, the most transparent being that with the lowest atomic weight, aluminium. M. Moreau dispenses with the Crookes' tube altogether, and uses the brush discharge of an induction coil; the curious result being obtained, that if the box containing the plate be placed normally to the brush, there is no effect, whilst placed parallel to the brush, strong, clear negatives are produced. No explanation of these experiments is attempted.

THE same number of the *Comptes rendus* also contains a second note by M. G. Le Bon, on photography with "dark light." By placing a sensitive plate under a negative, covered with a metallic plate 0·5 mm. in thickness, and exposing to the light of a lamp, good images are obtained on development, especially if a piece of lead is bent back over the frame, so that the whole printing frame is in a sort of metallic box. M. G. H. Niewenglowski mentions that these results can be obtained without any lamp at all, and hence suggests that they must be due to luminous energy stored up in the negative. But further experiments by M. Le Bon have completely eliminated this source of error, as the same results are obtained with negatives which have been previously submitted to blank experiments in the dark. From the point of view of Maxwell's theory of light, rays which can pass through 0·5 mm. of copper must differ essentially from ordinary light, and M. Le Bon proposes to next examine within what limits these dark rays submit to the laws of refraction, and how far they are affected by a magnetic field.

IT is announced that Dr. Kitasato, of Japan, has succeeded in inoculating for leprosy, and that the disease is curable.

THE formal presentation of the portrait of Mr. W. Carruthers, F.R.S., to the Linnean Society, was made at its meeting on February 6, by Sir W. H. Flower, on behalf of the subscribers.

THE Annual Congress of the French Association for the Advancement of Science will be held this year at Tunis, between the 1st and 11th of April. The Botanical Society of France will also hold its Extraordinary Session at the same place, and about the same time.

A COURSE of six lectures to working men, on "Fermentation," by Dr. W. P. Wynne, will be given in the Lecture Theatre of the Museum of Practical Geology, Jermyn Street, commencing on Monday, February 24.

A CONGRESS of Natural History and Scientific Societies of the South-East of England will be held at Tunbridge Wells on Saturday, April 25, under the presidency of the Rev. T. R. R. Stebbing.

THE practical extinction of the buffalo, or American bison, is very forcibly shown by an article recently published, which states that 300 dols. is now refused for a good buffalo robe, such as could at one time early in the seventies have been bought for a dollar, or even less.

WE are requested to state that the arrangements are now complete for lighting in the evening the Southern Galleries of the South Kensington Museum on the west side of Exhibition Road, which contain the collections of machinery and naval models. These Galleries will be open free to the public from February 17 on three evenings a week—Mondays, Tuesdays, and Saturdays, till 10 p.m.—in the same manner as the main building.

ANOTHER of the wonderful potentialities of the Niagara water-power is its application to the new process of Blumenberg for the manufacture of chlorate of potash by the action of the direct electric current upon tanks of potassium chloride. The electric current is at a remarkably low voltage. Important by-products are also obtained. Operations will begin next July. The Alkali Union, which controls the world's output of chlorate of potash, has reduced the price from 17 to 10 cents a pound, in anticipation of this undertaking; but the new manufacturers will probably undersell them in all the markets of the world.

THE new illuminant, acetylene, seems to be notable for its efficiency and the cheapness of its production by the electrical manufacture of calcic carbide, from which it is evolved by the mere application of water. Calcic carbide is already made at Spray, North Carolina, at a cost of 20 dols. per ton, by the alternating electric current passed through a mixture of powdered coke and lime. Works have been erected at Niagara which will produce the calcic carbide at 10 dols. a ton, beginning about the middle of this month. One ton of the carbide yields 11,000 cubic feet of acetylene gas, which has many times the illuminating power of common illuminating gas. The light, moreover, is clear and "solid"—that is, it has not the unilluminated centre of an ordinary gas-light. Acetylene gas is readily solidified, and may be conveniently distributed in cylinders, like carbon dioxide and other gases.

THE Geographical Survey of the United States has issued the report of a party of department geologists who recently made an extended investigation and survey of the Cripple Creek region. The mining district is thirty miles west of Colorado Springs, and seventy-five miles south of Denver. It covers an area of six miles in length by five and a half miles in width, between the two main ranges of the Rocky Mountains in Colorado. As long ago as 1874 it was thought that a big gold vein had been discovered near Mount Pisgah; and the second mining excitement was in 1884; but during these two periods not one of the really valuable ore bodies which are worked to-day was discovered. Rich ore was discovered in 1890, and the rush of miners began in 1892. The first gold in the district was produced in the latter part of 1891, and since that year the output has steadily increased, being variously estimated at 5,000,000 dols. to 7,000,000 dols. The ores of the Cripple Creek district are almost exclusively gold ores, with seldom silver enough to be important. The gold occurs both in a coarse and a fine condition, sometimes in particles so small as to be invisible to the naked eye, and at other times in plates or spongy masses from an eighth to a quarter of an inch in diameter. It is rarely clear and bright, and is generally coated with a thin rusty film of a yellowish-brown compound.

A GENERAL meeting of the Members of the Federated Institution of Mining Engineers will be held in Sheffield on Wednesday, February 19. Arrangements have been made for visits to cutlery and silverplate works and the technical schools in Sheffield on February 19, and to collieries and ironworks on the following day. The following papers are down for reading: "The Eastern Limits of the Midland Coal-field," by Prof. Ed. Hull, F.R.S.; "Electric Welding," by Mr. T. Scott-Anderson; "The Vibromotor as applied to the Screening of Small-coal," by Mr. Emerson Bainbridge, M.P.; "The Matabele Gold-fields," by Mr. F. G. Shaw; "Photography in the Technology of Explosives," by Mr. Alfred Siersch; "Lead and Lap of Winding and other Engines," by Mr. Hargrave Walters; "The Elliott Coal-washer," by Mr. J. Platt.

THE *Comptes rendus* for February 3 contain a paper by M. Maurain on the measurement of the energy dissipated in iron due to hysteresis. The amount of heat generated in a sample of iron when subjected to an alternating magnetic field is measured by enclosing the iron inside a cylindrical glass reservoir furnished with a capillary tube. This cylinder is filled with alcohol, and placed within a long magnetising coil. The reservoir being carefully protected from the heat generated by the passage of the current through the magnetising coil, the quantity of heat developed in the iron is deduced from the amount of the expansion of the alcohol. The development of heat due to Foucault currents is almost entirely prevented by using a bundle of very fine iron wires. The curve which gives, as a function of the time, the position of the surface of the liquid in the capillary tube during an experiment, consists of a straight line until the losses of heat due to radiation and conduction through the walls of the reservoir become appreciable when the line becomes curved. A preliminary experiment having indicated the form of this curve; in the final measurement care is taken that the observation does not extend beyond the straight part of the curve. The author finds that the quantity of heat developed during one cycle diminishes as the rapidity of the alternations increases. This diminution, however, becomes smaller and smaller as the frequency increases, and seems to be practically independent of the magnitude of the magnetising force. The author considers that the diminution observed is probably due to the screening action of the outside layers of the iron, and some experiments on which he is now engaged seem to favour this view.

THE number of the *Bulletin of Miscellaneous Information* of the Royal Gardens, Kew, for January, contains some interesting particulars of the effects on the Gardens of the long and severe frosts of the early months of 1895. These were in some respects different from what might have been anticipated from previous experience. Thus, while some herbaceous plants and shrubs reputed to be nearly hardy have perished, the laurustinus, the bay, and the arbutus escaped almost unharmed, as also did the evergreen oaks. "Alpines" suffered severely, though of course the cold was not so intense as the ordinary winter temperature to which many of them are exposed in their native habitat; but there they are protected through the winter by a covering of snow. The bamboos in the open ground were but little injured, while the pampas grass was largely killed. Of our native plants, the ling and the gorse were greatly damaged. Perhaps the greatest destruction was among the bulbs, of which very large numbers were entirely killed, especially the narcissi and hyacinths. In the same journal the number of visitors to the Gardens during 1895 is estimated at 1,407,369. This is about 30,000 more than the number for 1894, but somewhat less than the average numbers for the last ten years.

WE have received from Mr. J. Eliot, F.R.S., Meteorological Reporter to the Government of India, a preliminary discussion of certain oscillatory changes of pressure of long period and short period in India, being part ii. vol. vi. of *Indian Meteorological Memoirs*. The author points out that the discussion of pressure conditions in India requires that the observations should be of a high standard of accuracy, and for many years the greatest attention has been paid by the India Meteorological Department to the methods of observation, and to the critical comparison of the data. The first part of the paper deals with the normal conditions of pressure, and shows that the ordinary seasonal changes are very regular and uniform, while the abnormal conditions, such as are associated with the occurrence of storms, are, as a rule, very slightly marked. The largest regular oscillation is the annual change; the readings are highest in January, and fall until June, after which they rise until the end of the year. The amplitude of this change is smallest in Southern India, and increases with latitude. The smallness of the daily pressure changes is remarkable; only about five per cent. of the changes exceed a tenth of an inch. The second part of the paper deals in great detail with oscillations of pressure differing from the annual and diurnal changes, and which appear to be associated with atmospheric movements common to the whole of Southern Asia and the adjacent seas. In the long-period oscillations, the transfer of air across the equatorial belt tends during one half of the year to give an accumulation of air and high pressure over Central and Southern Asia, whilst in the other half of the year the air is drained away. The short-period oscillations are less regular than either the diurnal or annual, and approximately average four days in length. They appear to be common to the whole Indian area, and occur almost simultaneously; they are apparently not due to the transmission of waves in a horizontal direction, but possibly to waves of rarefaction and condensation, transmitted slowly upwards and downwards in the atmosphere, caused by variations of temperature. Although the discussion is only preliminary to a future paper, it teems with instructive matter which will well repay careful study.

A GOOD portrait of Lord Kelvin, reproduced by collotype, is presented as a supplement to *Industries and Iron* of February 7.

THE newly-established Société de Spéléologie of Paris has sent us the first three numbers of its quarterly journal, *Spelunca*. Accounts of caverns in various parts of the world are gathered together in the journal, several of them being illustrated by maps and other figures.

THE annual report of the New South Wales Railway Commissioners for 1894–95—being the final one for the original term of their appointment—contains, in addition to the ordinary very detailed statements, a full account of the extensive alterations and improvements made in the railway system since 1888. The report is illustrated by maps, photographs, and diagrams; and the statistical tables are admirably compiled.

THE January number of the *American Geologist* contains an account of the late Prof. J. D. Dana, with a portrait and bibliography. Mr. Warren Upham discusses the flow of glacial ice, with especial reference to the views of Messrs. Fletcher and Deeley, mentioned in these columns about a year ago. A description of cases of the flotation of sand, by Mr. F. W. Simonds, and an essay on the use of Palæontology as "The Timepiece of Geology," by Prof. Claypole, are among the other contents.

THE *Annuaire* of the Municipal Observatory of Montsouris for this year has just come to hand; the observations—meteorological, chemical, and bacteriological—tabulated and discussed in it, refer to the year 1894. Another *Annuaire* which we have received is that of the Belgium Académie des Sciences, des Lettres, et des Beaux-Arts. A full notice of the life and mathematical works of Eugéne Charles Catalan, with a portrait, appears in this annual of the Brussels Academy.

WITH the motto *Magnus magnes ipse est globus terrestris*, the new international quarterly journal, *Terrestrial Magnetism*, the forthcoming publication of which was announced in these columns a few weeks ago, has made its appearance. The articles in the journal are: "On electric currents induced by rotating magnets, and their application to some phenomena of terrestrial magnetism," by Prof. A. Schuster; "Die vertheilung des Erdmagnetischen Potentials in Bezug auf Beliebige Durchmesser der Erde," by Dr. A. Schmidt; and "Halley's Earliest Equal Variation Chart," by Dr. L. A. Bauer, the map being reproduced in facsimile. There are also letters, notes, and reviews dealing with terrestrial magnetism and cognate subjects. The journal is published under the auspices of the Ryerson Physical Laboratory, University of Chicago.

WE have had upon our table for some time a copy of Napier's celebrated and rare work on the construction of logarithms—"Mirifica Logarithmorum Canonis Constructio"—reprinted in facsimile by M. A. Hermann, 8 Rue de la Sorbonne, Paris. Napier's discovery of logarithms was announced in his "Mirifici Logarithmorum Canonis Descriptio," published in 1614; but the explanation of the method by which the logarithms were calculated appeared in the "Constructio," a posthumous work not issued until 1620. To this work, which M. Hermann has now reprinted, Henry Briggs, who was one of the first to recognise the value of logarithms, appended some notes. The reprint will be valued by all students of the history of mathematics.

THE Geological Society of London has just published a list of the geological literature added to its library during the year 1895. As compared with the only previous issue in this form, we note that while the price remains unaltered, the volume has swollen to nearly threefold—an increase only partly accounted for by the fact that the present list represents a whole year's additions as against a half-year's in the previous one. The omission of maps from the list, to which we drew attention when the previous list was published, has been repaired; maps are entered under the names of the authors responsible for them in the general list, but there are cross-references under "Maps" in the subject-index. The publication will be found a most useful one by all geologists.

THREE papers were read at the recent meeting of the Institution of Mechanical Engineers, viz.: "Telemeters and Range-Finders for Naval and other Purposes," by Profs. Barr and Stroud; "Calculation of Horse-power for Marine Propulsion," by Lieut.-Colonel Thomas English; "Notes on Steam Superheating," by Mr. William H. Patchell. The paper by Profs. Barr and Stroud was confined to a description of two instruments, viz. (1) the range-finder which is now in use in the navies of this and many other countries; and (2) a small hand instrument, identical in principle with that for naval use, but much more portable and much simpler in its details. Lieut.-Colonel English's paper called attention to a method of calculating, from the results of a single sea-trial of one ship, the horse-power necessary to propel another ship, of the same type, at any required speed. By this method it becomes practicable, with the ordinary appliances of a shipyard, to approximate closely to results which could otherwise be obtained only by the use of the refined apparatus of a model tank. Mr. Patchell described a number of superheaters, and gave the results of tests with them.

THE additions to the Zoological Society's Gardens during the past week include a Klippspringer (*Oreotragus saltatrix*, ♂) from Nubia, presented by Commander Alfred Paget, R.N.; an Indian Wolf (*Canis pallipes*, ♂) from India, presented by Mr. Duncan Darroch; a Barn Owl (*Strix flammea*), British, presented by Mr. Bernard R. White; a Gould's Monitor (*Varanus gouldi*) from Australia, presented by Mr. Arthur R. H. W. Leach; a Sharp-nosed Crocodile (*Crocodilus acutus*) from Jamaica, presented by Mr. Arthur P. Cohen; a West African Love Bird (*Agapornis pullaria*) from West Africa, presented by Mrs. Roberts; an Alpine Marmot (*Arctomys marmotta*), European, a Yellow-headed Conure (*Conurus jendaya*) from South-east Brazil, deposited; a Crested Grebe (*Podiceps cristatus*), a Curlew (*Numenius arquata*), British, purchased; a Malaccan Parrakeet (*Palæornis longicauda*) from Malacca, received in exchange; two Rufous Rat Kangaroos (*Hypsiprymnus rufescens*, ♂ ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE ASTROPHOTOGRAPHIC CATALOGUE.—At the last meeting of the Royal Astronomical Society, the Astronomer Royal gave some particulars relating to the progress at Greenwich of the international photographic star catalogue. A special staff for dealing with this work has been organised under Mr. Hollis, and already 130 of the plates taken for the catalogue have been measured. It is estimated that about 180 plates can be measured, and 160 of them reduced in the course of a year, so that at this rate the section allotted to Greenwich, comprising about 150,000 stars, will be completed in five or six years. Assuming that the other sixteen co-operating observatories are proceeding equally well, the world will soon be in possession of a colossal catalogue, comprising between two and three million stars.

ORBIT OF α CENTAURI.—Dr. Doberck, of the Hong Kong Observatory, has revised the elements of the orbit of α Centauri, which he determined in 1877, with the following results (*Ast. Nach.*, No. 3330).

☊ ...	$25^\circ\ 25'$	T ...	1876·02
λ ...	$52^\circ\ 53'$	e ...	0·51184
γ ...	$79^\circ\ 14'$	P ...	79·123 years
μ ...	$4^\circ{\cdot}54987$	a ...	$18''{\cdot}450$

The sum of the masses, as determined from these elements, is 2·3780 times the mass of the sun. Taking the parallax as $0''{\cdot}75$ the major semi-axis is 24·60 times the earth's distance from the sun, so that the distances between the components are about the same as those of the outer planets from the sun in our own system. If the diameters of the stars are not very different from that of our sun, each would appear from the other as a mere star to unaided vision, the distance being too great to show a disc. An ephemeris up to 1920 is given in the paper, as well as a comparison of observations with the places calculated from the adopted orbit.

COMETS OF SHORT PERIOD.—From an interesting article on comets of short period, by Mr. W. E. Plummer (*Knowledge*, February), we extract the following table, indicating the comets which may with reasonable certainty be expected to reappear.